

**Precalc Warm Up # 4-2**

Answer to 2 d.p. is typical for finance problems about rate or \$ amount. For time, t, let's go to 4 d.p.

How long will it take an investment to triple if invested at 9.5% annual interest rate compounded

- a) quarterly                      b) daily                      c) continuously

**HW Questions: p. 228**

**7.** Solve the following

(a)  $\log_2(x + 7) + \log_2 x = 3$

(c)  $\log_{10}(x + 7) + \log_{10}(x - 2) = 1$

(e)  $\log_2 x + \log_2 x^3 = 4$

9. Solve the following, giving an exact answer and an answer to 2 d.p.

(a)  $2^x = 14$

(d)  $\frac{1}{1-2^x} = \frac{12}{1}$

(g)  $10^{-2x} = 2$

(j)  $\frac{2}{1+0.4^x} = 5$

$$\frac{1}{12} = 1 - 2^x$$

$$\frac{1}{12} - \frac{12}{12} = -2^x$$

$$\frac{11}{12} = 2^x$$

$$\frac{\ln \frac{11}{12}}{\ln 2} = x$$

$$\ln 2$$

$$x \approx -0.13$$

10. Solve for  $x$

(a)  $(\log_2 x)^2 - \log_2 x - 2 = 0$

(c)  $\log_{10}(x^2 - 3x + 6) = 1$

(e)  $\log_x(3x^2 + 10x) = 3$

$$x^3 = 3x^2 + 10x$$

$$x(x^2 - 3x - 10) = 0$$

$$x(\quad)(\quad) = 0$$

a) let  $y = \log_2 x$

$$y^2 - y - 2 = 0$$

$$(y-2)(y+1) = 0$$

$$y = 2, -1$$

$$\log_2 x = 2 \quad \log_2 x = -1$$

$$2^2 = x$$

$$x = 4$$

$$2^{-1} = x$$

$$x = \frac{1}{2}$$

**11.** Solve the following simultaneous equations

(a)  $x^y = 5x - 9$   
 $\log_x 11 = y \rightarrow x^y = 11$

Use = values

( , )

**12.** Express each of the following as an equation that does not involve a logarithm.

(a)  $\log_e x = \log_e y - \log_e z$

13. Solve the following for  $x$

(a)  $\ln(x+1) - \ln x = 4 \longrightarrow \ln\left(\frac{x+1}{x}\right) = 4$

(c)  $\log_e(x+1) + \log_e x = 0$

$$\log_e x(x+1) = 0$$

$$e^0 = x^2 + x$$

$$0 = x^2 + x - 1$$

$$e^4 = \frac{x+1}{x}$$

$$e^4 x = x + 1$$

$$e^4 x - x = 1$$

$$\frac{x(e^4 - 1)}{e^4 - 1} = \frac{1}{e^4 - 1}$$

$$x \approx 0.019$$

14. Solve the following for  $x$

(a)  $e^x = 21$

(d)  $\frac{200e^{-2x}}{200} = \frac{50}{200} \longrightarrow e^{-2x} = \frac{1}{4}$

(g)  $\ln x = 3$

(j)  $\ln x - \ln(x+2) = 3$

$$\ln \frac{x}{x+2} = 3$$

$$e^3 = \frac{x}{x+2}$$

$$e^3(x+2) = x$$

$$e^3 x + 2e^3 = x$$

$$e^3 x - x = -2e^3$$

$$\frac{x(e^3 - 1)}{e^3 - 1} = \frac{-2e^3}{e^3 - 1}$$

$$x \approx -2.10$$

$$\cancel{x} = \frac{\ln 0.25}{-2}$$

$$x \approx$$

15. Solve the following for  $x$

(a)  $e^{2x} - 3e^x + 2 = 0 \rightarrow (e^x)^2 - 3(e^x) + 2 = 0$   
 (c)  $e^{2x} - 5e^x + 6 = 0$   
 (e)  $e^{2x} - 6e^x + 5 = 0$

16. Solve each of the following

(a)  $4^{x-1} = 132$   
 (c)  $3^{2x+1} - 7 \times 3^x + 4 = 0 \rightarrow 3^{2x} \cdot 3^1 - 7 \cdot 3^x + 4 = 0$   
 (e)  $3 \times 4^{2x+1} - 2 \times 4^{x+2} + 5 = 0$   
 (g)  $2\log x + \log 4 = \log(9x-2)$   
 (i)  $\log_3 2x + \log_3 81 = 9$

let  $y = 3^x$

$3(3^x)^2 - 7 \cdot 3^x + 4 = 0$

$3y^2 - 7y + 4 = 0$

$(3y-4)(y-1) = 0$

$3 \cdot 3^x - 4 = 0 \quad 3^x - 1 = 0$

$3^x = \frac{4}{3} \quad 3^x = 1$

$x = 0$

## Exponent and Logarithm Applications

Investment formulas...

### Simple Interest

(paid once in a year)

$$A(t) = P(1 + r)^t$$

### Compound Interest

(paid n times in a year)

$$A(t) = P\left(1 + \frac{r}{n}\right)^{nt}$$

### Compounding Continuously

$$A(t) = Pe^{rt}$$

\* When all else is equal, the yield (outcome) is better if the interest is paid more often.

### Effective Yield:

The actual percentage paid in a year.

Compare the yield of investing at 5.2% annual interest rate...

$$A(t) = P(1 + r)^t$$

$$A(1) = P(1 + 0.052)^1$$

$$A(1) = P(1.052)$$

↓  
5.2%

### Effective Yield if Compounded Daily?

$$A(t) = P\left(1 + \frac{r}{n}\right)^{nt}$$

$$A(1) = P\left(1 + \frac{0.052}{365}\right)^{365(1)}$$

$$A(1) = P(1.0534)$$

↓

Effective Yield: 5.34%

Group Event  
Counts as class activity points.

HW: PC book

p. 293 #5-13 odd, 21 - 37 ☐,

and 39, 49, 50

HW Week 2/3  
Weds:  
PC p. 284  
SL p. 227 & 228

Unit Test Fri:  
PC 4.1-4.5,  
SL 7.1, 7.4